

(1)

A CASE OF VOLVULUS OF THE SMALL INTESTINE AT A MECKEL'S DIVERTICULUM : TOGETHER WITH SOME OBSERVATIONS ON "SUBACUTE ILEUS" AND THE PERFORMANCE OF GASTROSTOMY FOR PARALYSIS OF THE SMALL INTESTINE.

BY PROFESSOR K. G. LENNANDER, M.D., LL.D., Hon. F.R.C.S.
Eng. and Edin.



Reprinted from the EDINBURGH MEDICAL JOURNAL. Edinburgh and London, Young J. Pentland, January, 1907.

A CASE OF VOLVULUS OF THE SMALL INTESTINE AT
A MECKEL'S DIVERTICULUM: TOGETHER WITH
SOME OBSERVATIONS ON "SUBACUTE ILEUS"
AND THE PERFORMANCE OF GASTROSTOMY FOR
PARALYSIS OF THE SMALL INTESTINE

By Professor K. G. LENNANDER, M.D., LL.D., Hon. F.R.C.S.
Eng. and Edin., *Upsala.*

CASE.—The clerk, N. J. N., from Dalccarlia, was admitted on 10th January 1906 to the surgical side of the Academical Hospital at Upsala, and died on 15th January. He had always enjoyed good health, with the exception of an acute abdominal attack during April and May 1905, which by his medical attendant was regarded as appendicitis. No resistance was felt at the time. After recovering from this, he had suffered no more from his stomach, although the action of the bowels had been rather sluggish, especially lately. On 8th January 1906 the patient was taken ill with pains in the cæcal region and a feeling of sickness; during the morning he had two spontaneous movements of the bowels, the last one rather loose. At noon, when the patient was seen by his physician, the abdomen was somewhat distended. To the right and somewhat below the umbilicus there was marked tenderness over an area of about the size of half a crown, and here could be felt a distinct resistance, well defined to the right. Rectal examination the same day revealed some tenderness forward and to the right, together with some increased fulness. Temperature, $37^{\circ}2$, $37^{\circ}5$; pulse, 68, 75.

On 9th January the tenderness had spread a little to the left of the middle line; the pains in the abdomen had also spread upwards as well as to the left; on percussion there was distinct dulness over the area of resistance; the tenderness per rectum not increased, but increased fulness could be felt. Eructations and nausea continued during the day, but towards evening were less troublesome. During the day the patient was given three small enemata of about $\frac{1}{2}$ litre tepid water; these gave some relief, but caused neither movement of the bowels nor escape of gas. The temperature in the morning was $37^{\circ}4$, at noon $37^{\circ}7$, in the evening $37^{\circ}5$; the pulse at the same periods was 77, 73, 74 to 68. In the afternoon the pain became more severe and more diffuse over the abdomen.

On 10th January, after a quiet night, his condition was as follows: the pain, as well as the tenderness, is still more widely diffused; the nausea continues; per rectum there is no increase of the tenderness or fulness; there is no albumin in the urine. In the morning the patient was given 3 cgrm. of morphia hypodermically. Temperature at 2 A.M., $37^{\circ}3$; pulse, 69; at 7 A.M., $37^{\circ}2$; pulse, 80 to 75; no chills.

No flatus had passed since the movement of the bowels in the forenoon of 8th January. The patient had taken no food since the evening of the 7th. From noon on the 8th to the afternoon of the 9th,

¹ A clinical lecture delivered in the Surgical Clinic at Upsala.

he got 50 drops *tinctura opii* in five doses of 10 drops. The patient was admitted to the hospital on 10th January at 6.30 p.m.

On admission, the patient was found to be a strongly built man in good general condition. There was no nausea. The pains were slight, and were diffused over the whole abdomen. Temperature, 38°; pulse, 92. White blood corpuscles, 7100, 7300, and 8100 per c.mm. at three different countings.

Local symptoms.—Diffuse and well-marked distension of the abdomen, with a tympanitic note everywhere except in the lumbar regions, where the note is somewhat dull. No resistance palpable. No peristalsis visible or palpable. There is great tenderness in the centre of the abdomen, over a nearly circular area with a diameter of 6 to 7 cms., and reaching about 1 cm. above the umbilicus. There is also tenderness, though less marked, from Poupart's ligament on the right side upwards to near the costal margin, and from there obliquely downwards to the fore part of the left iliac crest, *i.e.* nearly over the whole region of the small intestine. Per rectum a bulging tender mass can be felt. The outer opening of the inguinal canal is free on both sides.

The patient was operated on at 9 p.m., under ether, two and a half days after the commencement of the symptoms. The most likely diagnosis was volvulus of the small intestine, and it was considered possible that Meckel's diverticulum was involved also. *An inflamed Meckel's diverticulum was found*, adherent to the anterior abdominal wall near the umbilicus, and a *twisting* (at least through 360°) of *nearly the whole small intestine*. The constriction groove was found somewhat distal to the place of origin of the diverticulum, the proximal place of twisting was the duodeno-jejunal flexure. *There was a diffuse haemorrhagic sero-purulent peritonitis.*

Operation.—Extrication of Meckel's diverticulum. Untwisting of the small intestine. A Witzel's fistula was made in the jejunum 45 to 50 cms. from the duodeno-jejunal flexure; another in the ileum about 1 metre above the valve of Bauhin, and a third in the cæcum, all three being provided with tubes of 3 mm. diameter.

Account of the operation.—The incision was made in the middle line below the umbilicus; it was afterwards extended upwards, and the right rectus muscle was cut across. There was a haemorrhage, turbid fluid free in the peritoneal cavity. The small intestine was enormously distended, and tended to protrude. In the extra-peritoneal layer of the abdominal wall opposite the umbilicus there was a cavity the size of a medium-sized apple filled with fluid and gas; this was traced into a portion of small intestine which proved to be a Meekel's diverticulum. This originated from the ileum about $\frac{3}{4}$ of a metre above the valve of Bauhin. The ileum was red, and beyond the diverticulum it was distended to a girth of about 10 cms. The mesentery of the distended intestine was twisted at least 360° in an opposite direction to the hands of a watch laid upon the umbilicus with the face upwards. The diverticulum was dissected free from the anterior abdominal wall, and resected near the ileum. The undoing of the volvulus was followed by the escape of all the distended coils outside the abdominal cavity where they could no longer be lodged. They were washed with saline solution and covered with gauze wrung out of saline solution, over which was

laid a thick indiarubber sheet, and outside this again hot dry towels. After this two Witzel's fistulas were made in the small intestine, and by a process of "milking," the intestine was emptied through the tubes. The cæcum and the ascending colon had a long mesentery, free from the posterior abdominal wall, *i.e.* the ascending and transverse mesocolon passed from the spine in direct continuation with the mesentery of the small intestine hanging down from the vertebral column. During the operation they had been twisted once. They were put right, and the cæcum fixed to the abdominal wall by applying a Witzel's fistula in the position of the anterior muscular band. After this the small intestine was examined right up to the duodenum. The bowel was just as red as before, here and there were black spots (haemorrhages) of the size of a finger-nail. In the mesentery also there were numerous haemorrhages. In the vicinity of the Meckel's diverticulum the mesentery was folded by adhesions resulting from an old peritonitis. No signs of contraction could be seen in that part of the small intestine which had been twisted; even the jejunal part of the duodenum was widely dilated and paralysed. The portion of the bowel in the vicinity of the fistulae was fixed to the parietal peritoneum to the left of the abdominal incision by chromic catgut. On account of the distension of the small intestine the incision could not be closed, but the bowels were covered with an indiarubber sheet, and outside this were sewn compresses of sterilised gauze kept in place by means of sutures of metal or coarse silk passed through the edges of the abdominal wound.

When the Meckel's diverticulum was cut open, it showed a finger-wide piece of intestine, with swollen, red mucous membrane nearest the ileum. Suddenly this little intestine widened to a cyst of 6 to 7 cms. diameter containing purulent, feculent matter, and lined with a partly ulcerated mucous membrane. It was this cyst which had been found adherent behind the umbilicus.

The pulse was at the beginning of the anaesthesia, 96. At the evanescence no change of the pulse was observed; it was good and remained below 100 for nearly an hour, after which it slowly increased to 112, and later on to 120. Then a dose of 20 cgrms. camphor and 1 mgrm. strychnine was given subcutaneously, and intravenous infusion of saline solution was commenced. During the remainder of the operation the pulse improved and diminished in frequency, so that at the end it was 92 to 96, full and strong. In all the patient got 3 litres 0·9 per cent. saline solution with 16 drops of adrenaline (1 to 1000) into his veins.

The cæcal fistula was to be used for nourishing the patient. Through the fistulae in the small intestine the bowel was to be irrigated with saline solution. Through the lower one gases and coloured intestinal contents immediately began to escape, wherefore the injections through this fistula were stopped. During the following day and night about 4000 c.c. passed through this fistula. Through the upper one scarcely anything came. Fluid injected through this upper fistula did not come back. On account of the great quantity of fluid which passed through the lower fistula, the passage between the two fistulae was considered to be free, *i.e.* the greater part of the small intestine had immediately regained its power of contraction. As the patient felt sick and had eructations in the morning of 11th January, the stomach was washed

out at 10 A.M., and a large quantity of thin, badly smelling, brownish fluid evacuated. At 12 o'clock noon the stomach was again washed out, and a smaller quantity of the same kind of fluid brought up. At the washing done at 7 P.M. the contents were of a yellowish colour. At 4 P.M. the patient was given an enema, whereby much wind and thick coloured intestinal contents escaped per rectum. Simultaneously he was given subcutaneously 1000 c.c. saline solution with 5 per cent. grape sugar and 15 drops digitalis.

The temperature in the morning of 11th January was 40°·2, at noon 40°·4, and in the evening 40°; the pulse at the same periods being 140, 140, and 132. The urine contained traces of albumin, and gave Rosenbach's reaction for indol and skatol. The quantity of urine passed during the twenty-four hours was 1150 c.c. By the evening of the 11th it was evident that both the large and small intestines had recovered their function, with the exception of the duodenum and, in all probability, the jejunum above the upper fistula. At midnight on the 11th the patient was given subcutaneously 1 mgrm. physostigmine, which immediately caused the bowels to act. Much flatus and loose faecal matter were passed per rectum. During the 12th the patient received two intravenous infusions of 1500 c.c. saline solution with ~~✓~~ per cent. grape sugar and 8 drops adrenaline (1 to 1000), the one at 1.26 A.M. and the other at 1.28 P.M.

O. 3 During the night of the 11th and 12th, and up to the second operation at noon on the 12th, the stomach was washed every three hours, whereby badly smelling gastric contents of a deep yellowish colour came away. At 2 A.M. the intestine was irrigated, which caused highly coloured intestinal contents to escape. At 8 A.M. a tube was passed into the rectum, and a considerable quantity of gas and fluid intestinal contents got rid off; this was repeated at 11 A.M. and at 2 P.M.

O. 2 When, in spite of frequent washings, the contents of the stomach were feculent in odour, one concluded that there was paresis or kinking of the upper part of the jejunum, and consequently at 2 P.M. a *gastrostomy* was made. Local anaesthesia was effected by the application of anestile to the skin and aponeurosis in the linea alba, and a $\frac{1}{8}$ per cent. solution of cocaine with adrenaline was injected into the subserous tissue. A Witzel's fistula was placed in the pyloric portion of the stomach near the large curvature; the tube was of 5 mm. diameter. Directions were given that irrigations with ~~✓~~ per cent. hydrochloric acid solution were to be made through this tube. The fluid which escaped was to be collected in a bottle; and as soon as it had no perceptible smell, it was to be injected through the upper of the two fistulae in the small intestine, together with some Mellins' food, beaten egg, and bicarbonate of soda.

The general condition of the patient was satisfactory during the day. He did not complain of pain. The urine showed only a trace of albumin. The temperature was taken four times: in the morning 39°·5, in the forenoon 39°·3, at noon 39°·6, and in the evening 39°·6. The pulse at the same periods was: 140, 120, 148, 128.

January 13.—The patient having had no sleep, two tablespoonfuls of a solution of bromide of potassium were given a little before 3 A.M. through the lower fistula in the small intestine. A considerable quantity

of coloured matter and gas were got away by means of the rectal tube. At 2 P.M. the patient was given the first nutrient injection through the upper fistula in the small intestine, consisting of food mixed with secretion from the gastric fistula; again, at 4, 5, and 6 P.M., and so on hourly until midnight, there being at that time no more gastric secretion left to inject. He slept four hours. The urine showed a distinct ring of albumin. Rosenbach's indol reaction was negative. The quantity of urine passed during the twenty-four hours was 1320 c.c. The temperature was 39° 5, 39° 3, and 39° 4, and the pulse 124 and 120.

January 14.—A little after midnight the patient was given 1½ grm. bromide of potassium, and at 4 A.M. another ½ grm. through the upper intestinal fistula, which induced sleep for about two hours. As before stated, there being no gastric secretion since midnight, a gruel of 100 grms. of Mellins' food with a quarter of an egg and some bicarbonate of soda was given every hour through the upper fistula.

On 14th January, at 10 A.M., the pulse not being satisfactory (unequal, irregular, about 140), the patient was given an intravenous injection of 1500 c.c. saline solution with ~~1~~ per cent. grape sugar and 12 drops adrenaline. The pulse then became much better. At noon the patient was given 2 grms. bromide of potassium in solution, through the upper fistula. At 3.30 A.M. he was given 4·5 mgrms. morphia, after which he went to sleep and slept two and a quarter hours. At 6.30 A.M. the pulse had again grown worse, and he was given 1500 c.c. saline solution with ~~1~~ per cent. grape sugar and 10 drops adrenaline intravenously. At 10 P.M., 4·5 mgrms. morphia, after which he went to sleep and slept about four hours. About 2 A.M. on the 15th, he was unconscious and violent; later on he became quieter, but never quite conscious. The pulse was good until 4 A.M. He died at 9.30 A.M.

The quantity of urine passed on the 14th was 1650 c.c., and on the 15th 650 c.c. The patient had during the 14th and 15th consumed 2600 c.c. fluid. Nothing had passed through the gastric fistula nor through the fistula in the jejunum, but large quantities had escaped through the other two; faecal matter had also passed per anum. The whole intestine had thus regained its contractile power. The cause of death was probably stercoræmia, due to the absorption of faecal toxins (and bacteria) from the digestive tract, chiefly before the recommencement of peristaltic action.

EXTRACT OF THE POST-MORTEM EXAMINATION REPORT MADE ON 16TH JANUARY BY K. FREDGA, MEDICAL LICENTIATE.—The intestines lying in the wound were glued together and to the edges of the abdominal wound by fibrinous adhesions in such a way that the abdominal cavity was completely shut off. The intestine lying in the peritoneal cavity showed a few small patches of thin, fibrinous exudate, but the serous covering was otherwise everywhere smooth and glistening. The contents of the abdominal cavity consisted of a few tablespoonfuls of bloodstained, serous fluid. The diaphragmatic peritoneum and the serous covering of the true pelvis were normal. The ileum, which was lying in the cavity of the pelvis, and the lower part of the jejunum, were moderately distended by gas; the upper part of the jejunum and the duodenum were much distended, especially the highest part of the jejunum, which measured 8 to 9 cms. in diameter. The bowels con-

0, 3

0, 3

tained practically nothing but gas. The small intestines were everywhere injected, especially in the more distended portions.

Hæmorrhages were found in the mesentery, as had already been observed at the operation. No enlarged lymphatic glands could be found; two small swellings were incised, and found to be ha-matomata. No thrombosis of the mesenteric veins was discovered. When the small intestine was opened, the ileum showed swelling of the follicles, and the most distended part of the jejunum showed a well-marked diphtheritic process, beginning about 7 cms. above the proximal intestinal fistula and reaching about 40 cms. upwards, *i.e.* to about the duodeno-jejunal flexure. The mucous membrane of the stomach showed a few hæmorrhagic erosions. The transverse and sigmoid portions of the colon were full of gas. There was commencing infection in the spleen. The kidneys did not show any macroscopic changes. The liver substance showed multiple infarcts (hæmorrhagic, dark red, depressed patches), making in all about one-twentieth part of the whole liver.

In the liver no aderen

REMARKS.—The case illustrates very well the importance of the principles which have been advanced during the last few years. In the treatment of acute abdominal diseases, early diagnosis is the most important factor; if you can arrive at no definite diagnosis, make yourself in any case clear at once on the point *whether the patient needs operation or not.*

In this case it was no doubt very difficult to make a diagnosis during the first and perhaps the second day, especially for his own medical attendant, who was under the impression that the patient had had a slight attack of appendicitis a year before. He now considered the illness to be of the same nature, and hoped that the attack would subside as it had done on the previous occasion. But there was something new in the clinical picture; even at the doctor's first visit there was to be felt a tender resistance, situated near the umbilicus, immediately underneath the abdominal wall, and the abdomen was already somewhat distended. Although for more than two days the temperature was normal and the frequency of the pulse low, the abdomen swelled continuously, the patient suffered from nausea, and at times the pains were very severe. From the very beginning no flatus was passed, but, on the other hand, there was no vomiting.

The symptoms in this case were undoubtedly less severe than in any other I have previously seen in which there was twisting of the whole or of the greater portion of the mesentery of the small intestine.

On arrival at the hospital his general condition was remarkably good: temperature, 38°; pulse, 92; no albumin in the urine, no leucocytosis, no feeling of sickness, and hardly any pain. Against these symptoms there was: high tension in the abdominal cavity, considerable tenderness around the umbilicus without any palpable resistance, and some slight tenderness over the whole of the small intestine. Appendicitis having with some degree of

certainty been excluded, one was inclined to think of volvulus of the small intestine. Considering the resistance at the umbilicus which had been observed from the beginning of the illness, and the marked tenderness even on the slightest pressure, now present over the same spot, one thought also of a Meckel's diverticulum, which had become twisted and shut off from the bowel.

After opening the abdomen, a miserable picture presented itself, strongly contrasting with the "good general condition" of the patient. There was blood-stained, turbid fluid in the peritoneal cavity; the small intestines were bright red, were very greatly distended, and protruded through the abdominal incision. Even after enterostomy and "milking," they could not be returned to the abdominal cavity, but the whole wound had to be left open and the intestines covered with a sheet of indiarubber. During the operation no contractions were observed in the bowel which had been twisted.

It appeared to me that the explanation of the absence of vomiting before the operation might have been that the twist at the duodeno-jejunal flexure was not sufficiently tight to prevent the duodenum and stomach emptying their contents into the jejunum, until the pressure within the bowel had become too great. From the beginning of the attack the patient had taken nothing, not even water.

Every time a patient shows the clinical picture called ileus, the physician must try at once to find the cause. The previous history must be disclosed in its minutest details, and the condition of the abdomen carefully examined. The symptoms may be so plain that at once it becomes evident that one has to deal with a case of twisting of, for instance, the sigmoid flexure, or of an ovarian cyst. Excepting the incarceration of an external hernia, the symptoms are seldom so plain as in the above-named examples. In most cases one has to determine in the first instance the presence or absence of any one of the inflammatory diseases of the abdomen which by local or general peritonitis may cause "pseudo-ileus." Here we have to think of appendicitis, cholecystitis or acute pancreatitis, of a gastric or duodenal ulcer on the point of perforation or already perforated, of pyo-salpinx, etc. In those cases which begin subacutely and without temperature, the most important point to think of is the presence of adhesions in connection either with a previous attack of one of the above-named inflammatory diseases, or in connection with a hernia or a previous laparotomy. The importance of the previous history in these cases is obvious. Of no less importance is the history in other cases of subacute ileus (chronic ileus), in order that we may arrive at a well-founded suspicion or certainty as regards the presence of a growth of the intestine, tuberculous or other stricture or congenital or acquired malpositions of the intestines, all of them conditions which either slowly and perceptibly to the

patient, or suddenly and unexpectedly, may lead to occlusion of the intestine.

If it be impossible to arrive at a quick and definite diagnosis by the aid of the previous history and present condition, a diagnosis *ex adjvantibus therapiæ* must at once be resorted to. If you are certain to do no damage by these measures, you may give gastric and intestinal irrigations in quick succession. F. Léjahrs claims to have found great benefit from the electric enema.¹

If by these means the physician during the course of one to three hours cannot secure a free escape of flatus per anum, the patient should be transferred to a surgical hospital, where in the meantime everything is got ready for operation. Should the diagnosis be still uncertain, or there is not sufficient indication for an immediate operation, another attempt may be made to give relief by gastric and rectal injections under the control of the surgeon. If the desired result be not obtained, operation is then resorted to without delay.

The practitioner must understand that it is his duty to hand over to the surgeon a patient with an inflammatory or mechanical obstruction before that part of the bowel lying above the obstruction is damaged by *distension and by the accumulation of intestinal poisons and bacteria*. I said *inflammatory or mechanical obstruction* to the passage of the intestinal contents. I want to call attention to the fact that paralysis of a portion of a coil of intestine due to peritonitis causes, as long as the paralysis lasts, just as insurmountable an obstruction to the onward flow of the intestinal contents as, for instance, a volvulus of the bowel.

If we now think of our patient with the volvulus of the small intestine associated with a Meekel's diverticulum, the previous history pointed to appendicitis, whereas the superficial and tender resistance at the umbilicus spoke against this diagnosis. It was also remarkable, as I have already stated, that in presence of this resistance and a perfectly afebrile condition, the abdomen became more and more distended, the patient suffered from nausea and eructations, and no flatus was passed by the anus. In my opinion, this patient should have been sent to a surgical hospital during the first afternoon, 8th January, as a case of mechanical obstruction of the bowels. If the patient and the doctor had been doubtful on the 8th of January, careful, repeated irrigation of the stomach and of the colon would no doubt have convinced both of the presence of a "stop" somewhere. All medical men with practical experience agree that in a case of volvulus of the small intestine it is possible at the beginning of the illness, before there is paresis of the afferent portion of bowel, to empty the bowel above as well as below the obstruction fairly well by means of gastric and intestinal irrigation.

¹ F. Léjahrs, "Technik dringlicher Operationen," 1906, Aufl. 3, S. 464.

What we aim at is the *free passage of gases per rectum with collapse of the distended abdomen.*

It is lucky for the patient if a mechanical obstruction gives marked symptoms at the outset. His medical attendant ought then to be able to see that the case must go to the surgeon, and that there is no time either for doubt or delay. If, on the other hand, the symptoms of obstruction are ill-marked (*i.e.* the pains are slight, the abdomen distends slowly, and flatus is passed per rectum at intervals), then there is danger of the operation being delayed too long. Such conditions are often found during the after-treatment of cases of laparotomy; paretic bowel becomes adherent; some time elapses before it comes to a full stoppage; as long as possible it is hoped that everything will come right. When at last a second laparotomy is made, the picture is a very distressing one: distended, friable intestines and recent peritonitis taking its origin from the obstruction. "It was too late." Had it been possible at an earlier period to come to the conclusion that an obstruction was present, that there was a "full stop," and that only a second operation could give relief, one would, at the second laparotomy, find an adherent bowel which had been kinked, and that the distended coils of intestine above would have emptied themselves either at once, as soon as the adhesion had been separated, or after relief of the intestinal distension, by means of enterotomy, which might at once have been converted into an enterostomy if the intestine had not regained its power of contraction while the patient was on the table.

In all cases where the symptoms of ileus appear subacutely, with intervals, and of varying intensity, there is danger that the operation will be delayed too long, and that in spite of it the patient will ultimately die of stercoræmia. When there is faecal vomiting, it is almost impossible to save the life of the patient. The body can stand a certain amount of faecal poisoning —how much? how long? no one knows. Certain it is that the faecal poisons are not the same in all cases. It is probable that in many cases not only toxins but also bacteria pass early into the blood and lymphatic systems. Our patients therefore have every right to expect us to do our utmost to arrive quickly at a definite diagnosis, or at least to make sure whether an operation is needed at once or not.

The case of volvulus of the small intestine now under discussion would probably have recovered if the duodenum and the adjacent portion of the jejunum had at once been able to empty their contents through the opening made in the small intestine 50 cm. below the duodeno-jejunal flexure. At the autopsy "a well-marked diphtheritic process" was found, commencing 7 cm. above this opening, and extending from thence to the duodenum.

When making a fistula in the small intestine there is a danger of the bowel kinking on one or other side of it. To prevent this,

the bowel immediately above and below the fistula should be stitched to the parietal peritoneum. In this case, it was evident from the beginning that the intestine could not be obstructed immediately below the higher of the two fistulae, as fluid injected into this one escaped by way of the more distally placed one.

During the whole after-treatment nothing escaped through the upper fistula. During the first day and a half feculent matter collected incessantly in the stomach in spite of repeated irrigations. It was thus evident that the stomach and duodenum could not empty their contents into the jejunum. This condition might be due either to the jejunum being kinked above the upper fistula or the duodenum, and the above-named portion of jejunum being still paralysed, in spite of the other parts of the bowel having regained their power of contraction.

At the time when the gastrostomy was performed it was of no special importance to determine this point; it has been mentioned that the bowel was found to be distended and paralysed at the first operation. The increase in the distension during the next day and a half made it perfectly certain that it was paralysed at that time. Our object, therefore, was to provide for the escape of the bile and the pancreatic juice by making a fistula in the pyloric portion of the stomach. This was carried out at 2 p.m. on the 12th by Witzel's method, and after twenty-four hours the fluid which escaped from it was no longer bad-smelling, so that by this time the duodenum, and in all probability also the jejunum, had completely emptied themselves. After another ten hours nothing escaped from the gastric fistula, proving that the stomach, duodenum, and jejunum were able to empty their contents into the intestine below. Thus it was evident that the jejunum could not be kinked above the higher of the two intestinal fistulae, a fact that was also confirmed at the autopsy. It was then found that the first 40 cms. of the jejunum had a diameter of 8 to 9 cms., and showed a "well-marked diphtheritic process." The distended, paralysed bowel had fallen an easy victim to the poisons and bacteria within its lumen. The result would probably have been different if at the operation on 10th January I had made a gastric fistula instead of a jejunostomy. It was also found at the autopsy that the opening of the tube in the jejunal fistula was blocked by a swollen valvula Kerekringii. This explains why nothing flowed back through the tube when intestinal injections were made, and it teaches us that a fistula tube in the jejunum should reach at least 2 cms. into the lumen of the bowel, and have at least three holes at the intestinal end. The fact that the fluid injected through the jejunal fistula on the first day passed out through the fistula in the ileum, shows that the jejunum nearest the fistula soon regained its power of contraction, whereas the lower part of the duodenum and the uppermost portion of the jejunum remained paralysed about thirty hours after making the gastrostomy.

I consider that the cause of death in this case was diphtheritis of the intestine and toxæmia.

It is probable that the illness from which the patient suffered during April and May 1905 was an inflammation of Meckel's diverticulum, and not appendicitis. The diverticulum was now enlarged in its umbilical portion to a so-called entero-cystoma, filled with pus and faeces, and showing ulceration of its mucous membrane. As a result of the twisting of the small intestine, the healthy dilated portion of the diverticulum also became twisted, and thereby its contents were shut off from the rest of the intestinal canal. As the whole of the anterior surface of the cyst was adherent to the anterior abdominal wall, behind and to the right of the umbilicus, a quite superficial tender resistance could be felt already, a few hours after the onset of the attack. The tenderness, on pressure, increased both as regards intensity and extent, and at the operation an abundant extra-peritoneal oedema was found.

In this case, the colon and meso-colon to the right of the middle line had never become fixed to the posterior abdominal wall, but the colon, together with the caecum and the small intestine, was attached to a mesentery, which was quite free, and hung down from the bodies of the vertebrae, common to both small and large intestines.

This congenital malformation accounts for, on the one hand, invagination of the ileum, caecum, and colon; on the other hand, volvulus of a smaller or greater portion of the small intestine, together with the caecum and the right colon. How easily such a twisting may occur is shown by this case, where, during the untwisting and emptying of the small intestine, the caecum and ascending colon had become twisted a whole turn. In my opinion, a typhlostomy in the anterior tenia of the caecum would be an easy and effective way of preventing a recurrence of the twisting. Besides this, my intention with this oblique fistula was (1) to facilitate the emptying of the ileum, and (2) to allow the introduction of water and nourishment after the operation, until the small intestine had regained its contractile power.

I have previously pointed out¹ that if paralysed intestine, even after being partially emptied of its contents, cannot be replaced in the abdominal cavity, the best plan is to keep the wound open, and to leave those coils of intestines outside. I did so in this case; next to the intestine I placed a smooth rubber sheet, fastened by means of catgut sutures to the edges of the parietal peritoneum. Outside the rubber was put a large sterile, absorbent dressing, fastened to the abdominal wall by means of broad pieces of strapping, and outside of this a thick layer of

¹ See, for instance, my introductory paper to the discussion on Acute Peritonitis, at the International Surgical Congress at Bruxelles, 1905, *Edin. Med. Journ.*, 1905, vol. xviii, pp. 105, 237.

sterile, non-absorbent cotton-wool to keep the abdomen warm. That under such conditions a commencing, general peritonitis can be cured, is best shown by the necropsy in this case. The peritoneal secretion escapes between the smooth rubber sheet and the edges of the abdominal wound. The adhesions formed between the coils of intestine lying outside the abdominal cavity are much more easily separated than if the bowels are covered with gauze. The intestines lying underneath the rubber sheet sink back into the abdominal cavity as the bowel inside regains its power of contraction, and by emptying its contents becomes less bulky.

I may remark in passing that I now only tampon the abdominal cavity in cases where I consider it necessary to isolate a small portion of the abdominal cavity. In these cases I tampon with coarse 3-spun cotton thread. For drainage of the peritoneal cavity I use a thin, smooth rubber sheet, sometimes alone, and sometimes along with thin, soft rubber tubes.

If I resume what I have learned from this case, and from a case of acute dilatation of the stomach, together with volvulus of the ileum and the lower part of the jejunum, lately published by me,¹ my conclusions would be expressed as follows:—

1. If the stomach or the bowel has been distended to a certain degree, *i.e.* if the muscular coat has been stretched beyond a certain limit, these organs are unable to contract until they have been partially emptied. It was shown long ago by Blix that striped muscle does not recover its power of contraction after being stretched beyond a certain point.

2. At the operation the highly distended but not paralysed bowel looks as if it were paralysed, but if emptied of a part of its contents by means of enterotomy, it soon begins to contract, and is afterwards able to empty the rest of its contents through a fistula.

3. Paralysed bowel does not again contract, even after having been emptied of its contents.

4. If one wishes to bring about the recovery of a paralysed portion of intestine by means of enterostomy, the fistula must be placed above the paralysed part of the intestine.

5. As in many cases the paralysis also includes the uppermost portion of the jejunum, and probably also the duodenum below the papilla of Vater, there is in these cases no other way than to make a fistula (gastrostomy) in the pyloric portion of the stomach.

6. If at an operation I have emptied the contents of the small intestine, and in spite of this the jejunum shows no signs of contraction, I at once perform gastrostomy.

7. If, in a case where no indication for primary gastrostomy is found, the size of the abdomen increases, the frequency of the pulse rises or remains high, and two or three irrigations of the

¹ *Nord. Tidskr. f. Terapi*, Kjøbenhavn, 1905, May.

stomach show retention of foul-smelling or stagnant fluid, then there should be no delay in performing gastrostomy.

We have acted on these principles during the last six months, and in view of the results obtained, and which I hope soon to have an opportunity of publishing, I look a little more hopefully on paralysis of the intestine than I did last year. In a previous article¹ I insisted upon the necessity of the patient being subjected to operation before paralysis of the intestine has developed. Should this prove impossible, we have to provide for the emptying of the intestine by making one or more enterostomies, as was done in the present case.

Although the life of the patient may be saved by the making of fistulae in the small intestine, all surgeons will agree that they are better avoided, if possible. I am now of the opinion that cases of considerable paresis or paralysis of the intestine may be restored to health by emptying the intestine at the time of operation by enterotomy or colotomy, and reserving typhlostomy or gastrostomy, or both, as may be called for in special cases.

No organs are more suitable for an oblique fistula, made after the method of Witzel, than the cæcum and the stomach. The pyloric portion ought to be chosen, as, according to the investigations by Cannon, the fundus empties itself into the pyloric portion, and this latter through the pylorus into the duodenum. The pyloric portion empties itself into a fistula only when the passage through the pylorus is no longer available. This agrees with our experience. As soon as the passage through the small intestine is free (the paralysis of the small intestine having been recovered from), nothing escapes through the gastric fistula, if the patient is not allowed to consume a great quantity of fluid at one time. If an oblique fistula has been made in the cæcum or stomach with a tube of 5 mm. diameter, and the operation has been undertaken at a period of the illness when the walls of these viscera are still relatively healthy, it may always be reckoned upon that the fistula will close as soon as the tube is withdrawn.

The suggestion to deal with the paralysis of the intestine which complicates peritonitis by means of gastrostomy is not new; but, as far as I know, only one case has been published—by Jaboulay²—which has been thus treated. F. Léjahrs mentioned it in his introductory paper on acute peritonitis at the International Surgical Congress at Bruxelles, 1905. After having described enterostomy, Léjahrs says: "Let us, lastly, note a case of gastrostomy, made by Jaboulay in order to counteract a severe degree of distension of the stomach, and which greatly relieved respiration and at last restored health. This is a very interesting experiment, which is to be remembered and repeated in those cases where irrigation of the stomach cannot be done or does not suffice."

¹ *Loc. cit.*

² Jaboulay, *Lyon mèd.*, 1905, March 12, p. 560.

